## Proposed Agreement between California Energy Commission and EnerNex Corporation

**Title:** Utility Scale Solar Forecasting, Analysis and Modeling
**Amount:** $450,000.00
**Term:** 45 months
**Contact:** Gail Wiggett
**Committee Meeting:** 3/16/2011

### Funding

| FY | Program | Area | Initiative | Budget | This Project | Remaining Balance | |
|---|---|---|---|---|---|---|---|
| 09 | Electric | Renewables | Utility-Scale Renewables | $4,800,000 | $450,000 | $0 | 0% |

### Recommendation

Approve this agreement with EnerNex Corporation for $450,078.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

### Issue

According to Governor Jerry Brown's new energy plan, by 2020, California should produce 20,000 new megawatts (MW) of renewable electricity. Furthermore the Governor calls for the Legislature to codify a requirement that 33% of the state's electricity be derived from renewable sources. This step builds upon Governor Arnold Schwarzenegger's Executive Order S-14-08 that directed state government agencies to take actions to help achieve California's Renewable Portfolio Standard (RPS) goal, which requires electricity retail sellers to serve 33 percent of their load with renewable energy by 2020.

Governor Brown's energy plan builds even further upon these goals, adding the additional goal of 12,000 megawatts of Localized Electricity Generation; 8,000 Megawatts of Large Scale Renewables; and increasing combined heat and power production by 6,500 megawatts. Localized energy is onsite or small energy systems located close to where energy is consumed that can be constructed quickly (without new transmission lines) and typically with relatively low environmental impact. Combined heat and power projects (also known as cogeneration) use the excess heat or electricity generated by power plants or industrial facilities and are much more efficient than traditional power plants and many industrial plants.

Solar development and particularly utility scale solar development is a crucial part of achieving these various goals in Governor Brown's energy plan. The California Public Utilities Commission (CPUC) suggests that the technology mix, for the baseline scenario to reach 33 percent by 2020, will primarily rely on wind, solar thermal, geothermal, solar photovoltaics (PV) (at generation of 44 percent, 24 percent, 15 percent, 9 percent respectively) and the rest from low levels of biomass, biogas and small hydro (generation of 4 percent, 3 percent and <1 percent respectively).

As such, the need for reliable solar resource forecasts is becoming more important each year as increasing amounts of weather variable solar-generated electricity is incorporated into the electric grid.

To facilitate integration of solar resources into an electric grid, forecasting capabilities for various time intervals need to be configured. These include: short-term forecasting for less than one hour to 3 hours ahead for frequency regulation and load following; day-ahead forecasts for informing unit commitment activities; and long-term forecasts for system planning and economic analysis purposes. The key to short- and intermediate-term forecasting is successful prediction of the shadowing effects of clouds using a variety of physical and statistical tools. Alternately, long-term forecasts for solar PV will entail incorporating an accurate model of PV variability into a system model of the grid at an appropriate scale and determining the impacts and remedies therefrom.

## Background

On November 2, 2010 the California Energy Commission (Energy Commission) PIER Renewable Program released a Request for Proposals (RFP) for research needs of utility-scale renewable energy. The RFP announced that up to $7.3 million was available from the PIER Program to fund initiatives that will help meet Research, Development and Demonstration (RD&D) needs related to more rapid and environmentally responsible deployment of Utility-Scale Renewable Energy (USRE) to the California electricity grid. The goal of the RFP was to support increased market penetration of multiple renewable energy technologies; reduction of impacts on land use, water consumption, and ecosystem resources; and mitigation of technical and economic barriers to the increased injection of non-baseload renewable energy sources into the transmission system.

Outreach to expand awareness of the RFP included pre-proposal workshops on November 9, 2010 held in the Energy Commission's Hearing Room A, in Sacramento, California and on November 16, 2010 held in the George T. Booker Conference Room in the University of California San Diego. The workshop covered in detail the application process, and provided a forum for questions and answers. The workshops, RFP, and questions and answers were advertised and published on the Energy Commission website.

On the proposal due date of December 21, 2010, the Energy Commission received 28 proposals. In accordance with the 2010 RFP Package, each proposal was screened for completeness, and reviewed by Energy Commission staff. Nine proposals were rejected from the administrative screening process. The Technical Advisory Committee reviewed, evaluated, and scored the proposals using the criteria prescribed in the Application Package.

## Proposed Work

The proposed research will address both short-term and long-term forecasting needs. Short-term forecasts will combine satellite and ground-based sky imagery shading models into a best-possible forecast of solar plant output. Forecast performance will be validated against output from rooftop solar facilities in Fontana, California, and improvements to forecasting capabilities versus clear-sky and persistence models will be verified. Long-term forecasting will focus on the effects of increasing of penetration of solar PV to as much as 45 percent in the Inland Empire area of Riverside and San Bernardino counties. The general approach will be to develop a control area system model that includes the anticipated levels of and variability of solar PV, and run the models to determine the effects of increasing penetration on regulation and ramping needs, and developing strategies to reduce those needs based on short-term forecasting capabilities. Additionally, the inherent variability of PV captured by the high-resolution solar and forecasting data collected for the short-term forecasts will be utilized to re-

evaluate control responses to feeder disturbances that were originally developed for conventional generation.

## Justification and Goals

This project "[will develop, and help bring to market] advanced electricity technologies that reduce or eliminate consumption of water or other finite resources, increase use of renewable energy resources, or improve transmission or distribution of electricity generated from renewable energy resources" (Public Resources Code 25620.1.(b)(4)), (Chapter 512, Statues of 2006)).

This will be accomplished by:

- Developing a short-term forecasting tool for predicting solar plant output in the seconds-ahead to hours-ahead timeframe.
- Demonstrating and validating the solar forecasting tool at several locations in the Inland Empire area of Southern California.
- Developing long term system forecasting models for predicting the system effects of high-levels of penetration of variable solar generation resources.